Sensors for Health Recording and Physical Activity Monitoring

Guy Carrault, Frédéric Guidec, Jacques Prioux, Di Ge, Juliette Boulanger

SHERPAM

Sensors for Health Recording and Physical Activity Monitoring

- LTSI - INSERM 1090
- CASA - IRISA UMR 6074
- M2S - CACHAN UR2
- LAUREPS - CRPCC, EA 1285
- CIC 1414

OBJECTIVES

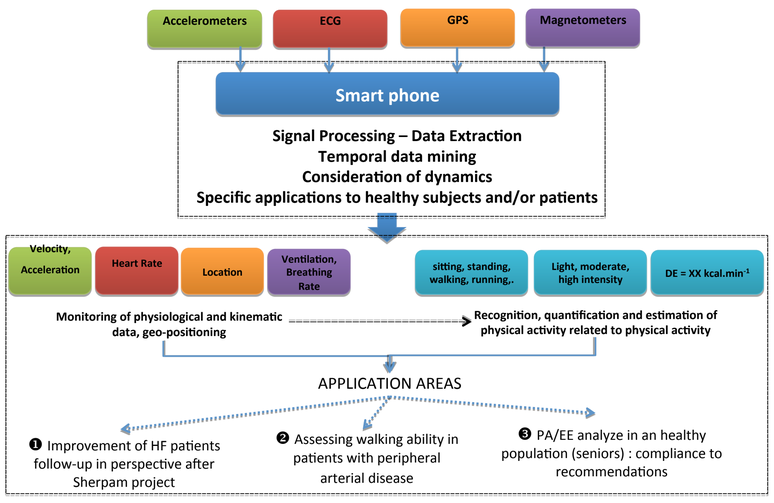
Conceive, **implement**, and **validate** experimentally devices allowing biophysical data of mobile subjects to be gathered and exploited in a continuous flow.

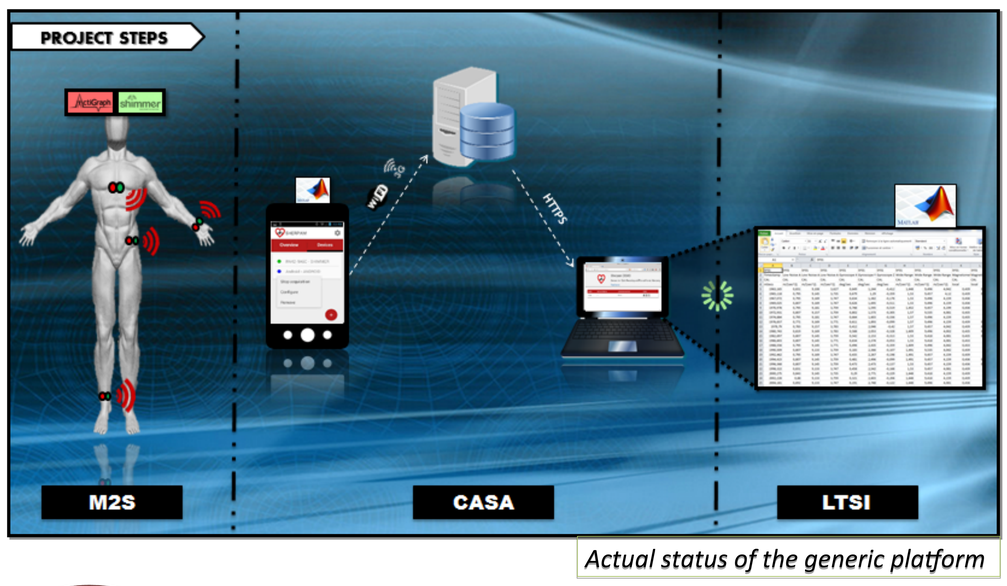
Focused application domains:

- Heart failure patient's monitoring (HF).
- Outdoor assessment of functional limitations and community-based walking programs for rehabilitation in patients with peripheral artery disease.
- Physical activity recognition and energy expenditure estimation,

GENERAL ARCHITECTURE OF THE PROJECT

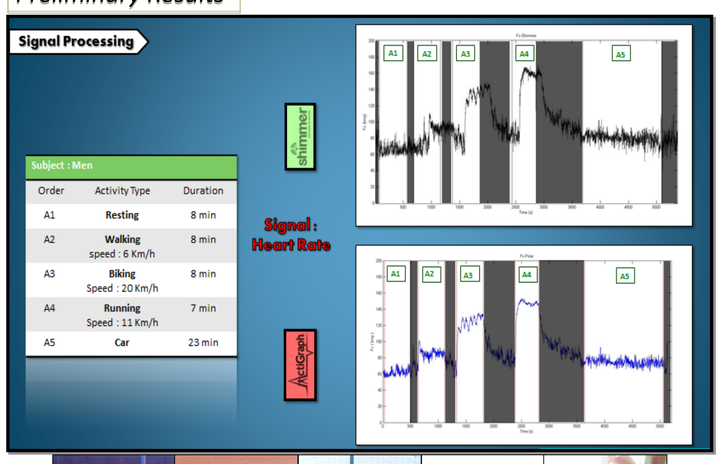
Global design of the study

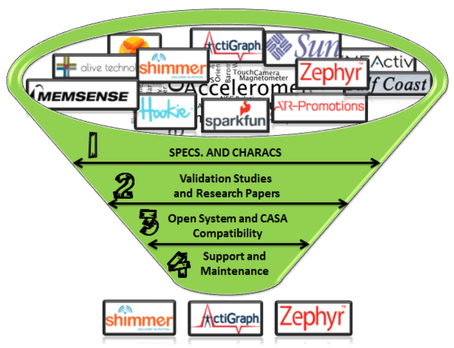


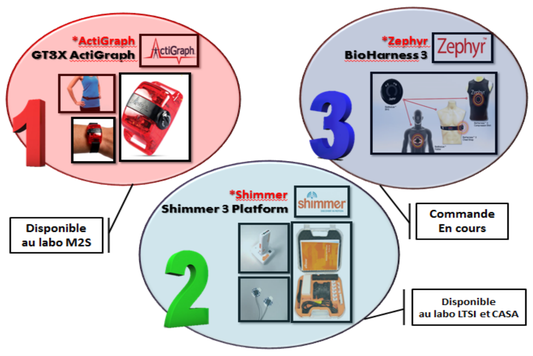


Actual status of the generic platform

Preliminary Results





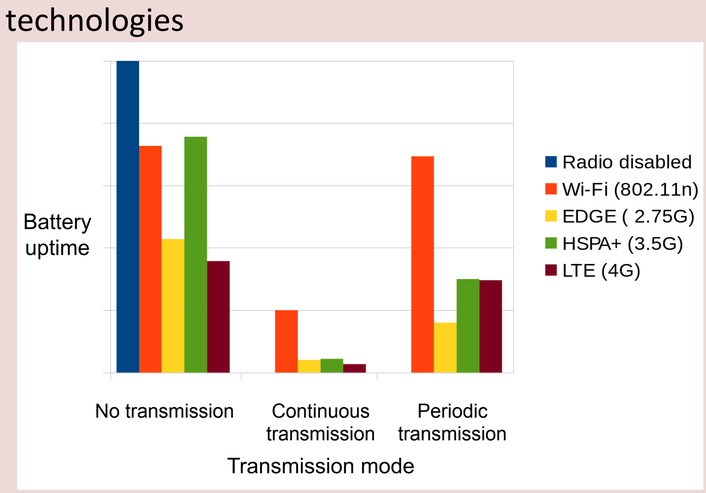


Sherpam project design with respect to human factors

MAIN RESULTS

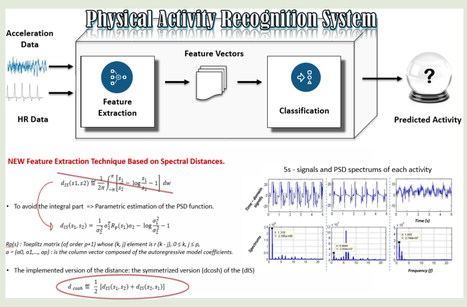
IRISA-CASA

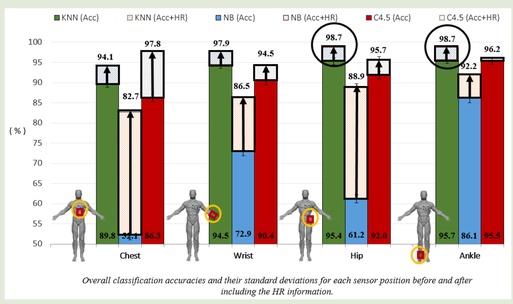
1) An open platform dedicated to mobile monitoring built around four criteria :
   - Versatility : to accommodate to a large variety of off-the-shelf sensors
   - Extensibility : to add new sensors and embedded processing easily
   - Confidentiality : to ensure the privacy and the non-disclosure of the data
   - Dependability : to work everywhere by limiting the energy consumption (EC) and by provding a resilience to network disruption
1) A plugin approach for both sensors and embedded algorithms to personalize the platform for each patient and his/her condition
2) Evaluation of EC of various transmission technologies



LTSI/M2S

1) Develop signal processing tools to :
Recognize and classify five ambulatory and sedentary activities (cycling, walking, running, sitting, car-riding) using heart rate and acceleration data fusion.

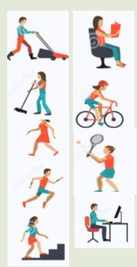




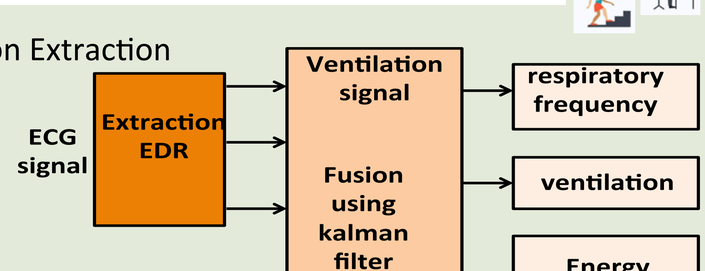
Overall classification accuracies and their standard deviations for each sensor position before and after including the HR information.

2) Develop a new experimental protocol for daily-life activities recognition and energy expenditure estimation:

Experimental Phase 1
⇒ Develop mathematical models for activity recognition and energy expenditure estimation
Experimental Phase 2
⇒ Test the strength of developed models in Phase 1 on the basis of semi-standardized activities.
⇒ Ameliorate the recognition models if necessary.
Experimental Phase 3
⇒ Test the strength of developed models in Phase 1 and ameliorated in phase 2 on daily-life activities situation.

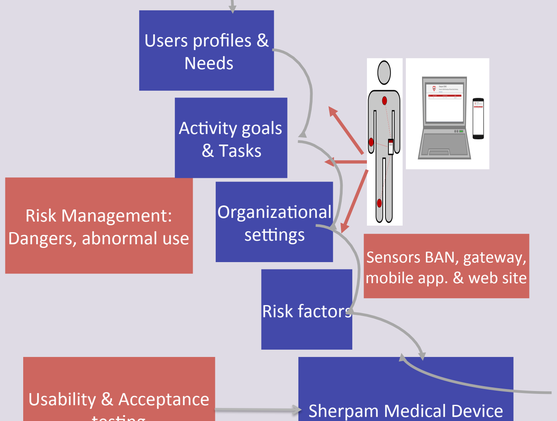


3) ECG-Ventilation Extraction



LAUREPS-CIC-IT

1) Context of Sherpam use understanding
2) User's profiles and requirements
3) Authentication of primary functions and risks of sensors/gateway/mobile app. /web site use
4) Review wearable sensor acceptance and usability



Publications

Biomedical Signal Processing and Control (Journal, 2016) - Mobihealth'16 - 6th EAI International Conference on Wireless Mobile Communication and Healthcare (November 2016) - Healthcom'16 - 18th International Conference on e-Health Networking, Applications and Services (September 2016) - *ECSS'16 Conference - Advances in Biomedical Engineering (ICABME'15) International Conference and then published in IEEE Conference proceedings.*